

But to return to the unknown drift-fruit. It is seldom that specimens remain at Kew for a long period without something occurring to call attention to them. It was so in this instance. In November 1887, Mrs. Hubbard sent Prof. Oliver a drift-fruit from the coast of Devonshire which was found to be exactly identical with the fruits collected at Jamaica. The specimen had the same water-worn appearance, and there was little doubt that it had travelled across the Atlantic in the drift of the Gulf stream.

This fruit, a representation of which is given opposite, possesses such distinctive characters that it can easily be recognized. It is evidently a drupaceous fruit, but the fibrous or fleshy outer layer (the sarcocarp) has either decayed or been worn away while drifting. What is now left is the woody indehiscent putamen or pericarp, externally marked by a mammillated surface corresponding, as shown in sections, with numerous cavities or resin-cysts existing in its walls. The fruit is normally five-celled, but two of these are suppressed, and only three remain. The seeds, as shown in Fig. 3, are solitary, and they possess abundant albumen. The presence of resin-cysts is a character of some value in seeking for the order or genus to which such a fruit could belong. In the Kew Museums, there are some fruits collected by G. Mann, on the Gaboon River, West Africa, which afford a clue. These are the fruits of *Aubrya gabonensis*, Bail, belonging to the natural order *Humiriaceæ* (Oliver, "Flora Trop. Afr." vol. i. p. 275). They are smaller than the Jamaica drift-fruit, and are covered with a brown, fibrous or leathery epicarp 3 millimetres in thickness. The bony endocarp is, however, similarly developed and plentifully furnished with resin-cysts. The resemblance altogether is very close. The natural order *Humiriaceæ* is a very small one, and consists of genera entirely confined to Brazil and Guiana, with the exception of the single African genus already mentioned. There can be little doubt that the drift-fruit is derived from tropical America, and not from Africa. The American genera of *Humiriaceæ* are *Vantanea*, *Humiria*, and *Sacoglottis* ("Gen. Plant." vol. i. p. 247). It is not necessary to give all the details, but I may say at once that Prof. Oliver is of opinion, and in this I agree, that the drift-fruit will doubtless be found to belong to a species of *Humiria*, and possibly to *H. balsamifera*, Benth. (Hook., *Kew Journ.*, vol. v. (1853), p. 102).

This species is said by Aublet (who figures the leaves and flowers only in "Plant. Guian." p. 564, t. 225) to grow in all the forests of French Guiana, where it is known, from the colour of the wood, as *bois rouge*. Strange to say, the fruit of apparently so common a plant is unknown in European herbaria. Urban, who described it, with a figure, in "Flora Brasiliensis" (vol. xii. p. 439, t. 92), had not seen a mature fruit. The specific name is derived from the fact that the bark, when wounded, yields a reddish balsamic juice, possessing an odour like that of storax, and which after a time becomes hard and brittle. It is then used as a perfume. An ointment is also prepared from it.

For the present, therefore, we must leave the question open as regards the exact determination of this drift-fruit. There can be little doubt that it belongs to the genus *Humiria*, but until we obtain fruits of *H. balsamifera* we are unable to say whether it is that species or not.

D. MORRIS.

P.S.—Since the above was in type, I have gathered information which considerably increases the interest connected with this fruit. It is first figured and described (as a drift-fruit) by Clusius in his "Exoticorum libri decem," lib. 2, cap. 19. This work bears the date of 1605. The description adds nothing as to the origin of the fruit, except that it was received from Jacob Plateau. The figure given by Clusius, with the description, is reproduced by J. Bauhin, nearly eighty years afterwards, in

"Historia Plantarum" (1680), tom. i., lib. 3, cap. cxi., Fig. 1. There is another figure, still from a water-worn and drifted specimen, given in "Petiveri Opera," tab. lxxi., Fig. 5 (1764), with the information that "it is a hard oval fruit with seed-holes [resin-cysts] round its surface. Cat. 605. Found on the shore of Jamaica." Finally, Mr. E. G. Baker, F.L.S., to whom I am indebted for the references to Bauhin and Petiver, has recognized the fruit in the Sloane Collection at the British Museum (Natural History), labelled "No. 1656." We are still, however, without information as to the origin of the fruit or the plant bearing it.

D. M.

HAZE.

I HAVE for some time given in my lectures an explanation of the common summer haze which appears to me to be very probable. I do not know whether it is new, but it has not been referred to in the discussion raised by Prof. Tyndall's letter on Alpine haze. Some time since I mentioned it to Prof. Lodge, and at his suggestion I send it to you, though its extension to other kinds of haze is somewhat speculative.

It is that haze is often due to local convection currents in the air, which render it optically heterogeneous. The light received from any object is, therefore, more or less irregularly refracted, and, through the motion of the currents, its path is continually varying. The outline of the object, instead of appearing fixed, has a tremulous motion, and so becomes ill-defined. At the same time, reflection occurs where there is refraction at the surfaces of separation of heterogeneous portions. Much of the light which, in a homogeneous medium, would come straight from the object, is thus lost for direct vision, and the contrast between neighbouring objects is lessened. The reflected light is diffused as a general glare. The combination of the quivering of outline, and the loss of direct light, with the superposition of the reflected light as a diffused glare, gives the appearance we call haze.

This explanation appears to me to accord well with the obvious facts of summer haze—the haze which is seen in the middle of a hot, cloudless, summer day. The lower layers of air, being heated by contact with the earth, rise in temperature till equilibrium is no longer possible, and convection begins, streams of the heated air rising, and streams of colder air falling to take its place. The variation of temperature and density gives optical heterogeneity. The existence of these streams is sometimes shown by the quivering of distant objects, looked at through the air close to the ground, but a telescope will often show the quivering of outline at higher levels, and when quite invisible to the naked eye. Accompanying this refraction, reflection must occur. We have a direct proof of its occurrence in the fact that the glare is greatest under the sun, where reflection occurs at angles approaching grazing incidence, for which it is a maximum; while it is least opposite the sun, where reflection occurs at angles approaching normal incidence, for which it is a minimum. The opening lines of the "Excursion" perfectly describe the resulting appearance:—

"'Twas summer, and the sun had mounted high;
Southward the landscape indistinctly glared
Through a pale steam; but all the northern downs,
In clearest air ascending, showed far off
A surface dappled o'er with shadows flung
From brooding clouds."

During the night the lower strata become colder than the upper ones, and the atmosphere passes into a state of stable equilibrium. We should therefore expect that, if the foregoing explanation is true, there would be

complete absence of haze, and it is well known that the air is peculiarly clear in early morning, when we get above the fog-level.

According to this account of heat haze, it stands in sharp contrast to fog, of which it is so often supposed to be a relative in reduced circumstances. While the one requires convection, the other usually occurs when the air is in stable equilibrium, the lowest strata being the coldest. In the fog, for example, which so frequently heralds or accompanies the break-up of a frost, the lower strata are still cold, while above the wind has changed, and the air comes up warm and vapour-laden. The vapour diffuses downwards into the lower, cold strata, and is there condensed, and it is possible that the more rapid diffusion of water vapour has something to do with the continuance of the fog, for it would diffuse downwards more rapidly than the rest of the air with which it has come.

There are other cases of haze which may, perhaps, be explicable by optical heterogeneity. In the dry east winds of spring we frequently have a haze when the air is far from saturation-point, and the clouds, if they exist, are at a high level. It appears possible that this haze is due to small convection currents of the cold air from above, the temperature falling too rapidly from below upwards for equilibrium.

Sometimes the heterogeneity may be due to water vapour. After rain, when the ground is still wet, the drying of exposed surfaces often shows that the air is not saturated, yet there is a haze or mist which is supposed to be thin fog, *i.e.* water-dust. Evaporation must be going on, and the air must certainly be unequally charged with vapour. With this inequality there must also be convection. I have never been able to detect, with certainty, quivering of outline either in this case or in the previous one of the east wind haze, though I have sometimes suspected its existence. Possibly someone who has used a high-power telescope for terrestrial objects might be able to give information on this point. But it is to be noted that the differences of density in both these cases are much smaller than in the case of summer haze, and the currents should therefore be on a smaller scale.

It seems worthy of inquiry whether the haze observed under cumulus clouds, referred to by the Rev. W. Clement Ley, may not also be due to water-vapour heterogeneity. The cumulus cloud indicates the existence of a large body of vapour-laden air extending no doubt below, as well as above, the condensation level. As this mass sweeps along, the lower part of it is retarded by the earth and by the lower strata, and more or less disturbance and mixture with the surrounding air will occur. There will therefore be heterogeneity. I do not know whether this would be at all sufficient to account for the haze observed, but the suggestion seems worth considering.

J. H. POYNTING.

THE EARTHQUAKE AT EDINBURGH.

THOUGH no earthquake of great destructive energy has passed across the area of the British Islands within historic times, the number of actual shocks which have been experienced and recorded amounts now to many hundreds. Scotland, being more generally mountainous than the other divisions of the United Kingdom, has hitherto enjoyed by far the largest share of these manifestations of terrestrial disturbance. Hardly a year passes without adding to the list. The latest addition is that which startled the inhabitants of Edinburgh, on Friday morning, the 18th instant, a few minutes before 7 o'clock, when a large part of the population was still in bed. It agreed in general character with the usual type

of Scottish earthquakes, and might indeed be taken as an illustrative example of them—not strong enough to do damage to property or life, but yet quite sufficiently marked to arrest attention and to exhibit some of the more prominent features of seismic movements.

The earthquakes that visit Scotland so frequently are always singularly local in character. Now and then a more vigorous shaking may be felt across the breadth of the Highlands, but as a rule the tremor is confined to a comparatively circumscribed district. Again, not only are they local, but there is usually some centre or median belt of ground where the effects have been more distinctly perceptible than elsewhere. Some districts are specially liable to them. Thus, the tract around Comrie, in the south of Perthshire, has long been noted for the frequency of its earthquakes. Another area often similarly affected embraces the West Highlands up to Inverness. It is worthy of remark that this latter region was considerably disturbed by a series of shocks almost exactly a year before, *viz.* on February 2, 1888. If we look at the geological structure of these earthquake districts, we observe that they are traversed by some of the most important lines of fissure by which the crust of the earth within the area of Britain has been disrupted. Comrie stands on the line of a powerful fault which runs across Scotland from sea to sea, and which, by bringing the softer and less prominent sandstones of the low country against the harder and more precipitous schists of the hills, has been in some measure the origin of the line between the Lowlands and Highlands, and thus of the limitation of the Saxon and the Gael. Again, in the West Highlands, a profound dislocation has defined the line of the Great Glen from Inverness to the Linnhe Loch. The relation of the chief earthquake centres to these ancient lines of fracture in the terrestrial crust can hardly be accidental. The actual shock that starts the seismic wave is probably in these areas to be traced to some slipping of the rocks along these lines of rupture. Though the faults are of great geological antiquity, they doubtless remain lines of weakness, along which any changes due to the secular cooling and contraction of our planet may be expected to show themselves.

The area shaken by the earthquake of Friday, January 18, is not one which has been much subject to experiences of this kind, though a few shocks are spoken of as having been felt there in the past. But its geological structure shows how well fitted it is to become a theatre of disturbance of the usual feeble Scottish type. It extends from the edge of the Firth of Forth southwards into the interior across the site of Edinburgh, and thence along the chain of heights known as the Pentland Hills. These hills consist mainly of volcanic rocks belonging to the period of the Lower Old Red Sandstone. The beds of lava and sheets of tuff increase in thickness towards the north-east, until in the Braid Hills, which lie immediately along the southern outskirts of Edinburgh, they are replaced by the materials that fill up what seems to have been the chief vent from which they were discharged. These volcanic eruptions had long ceased when the Carboniferous rocks of the district began to be laid down upon their upturned and worn edges. During a prolonged period of deposition and depression they gradually sank and were buried under some thousands of feet of sedimentary strata. In later times the area was disrupted by a group of long parallel fractures running in a general north-east and south-west line. Vast denudation likewise took place. By degrees the deep cover of Carboniferous strata was worn away from the tops of the volcanic ridges which now once more appear at the surface as the chain of the Pentland Hills. Thus the site of the earthquake coincides with an ancient volcanic centre and with a belt of country which has been dislocated by lines of fault.